Traffic Impact and Access Study

Proposed Tiverton Crossings

Tiverton,
Rhode Island

Prepared for **Carpionato Group, LLC**
1414 Atwood Avenue
Johnston, Rhode Island 02919

Prepared by ***VHB*/Vanasse Hangen Brustlin, Inc.**
10 Dorrance Street, Suite 400
Providence, Rhode Island 02903

December 2013

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1 Introduction

Vanasse Hangen Brustlin, Inc. (VHB) has conducted a traffic impact and access study to evaluate impacts associated with a proposed 454,481± square foot mixed-use development known as the Tiverton Crossings located in Tiverton, Rhode Island. The project consists of constructing a hotel, restaurants, residential, office, and retail space on existing undeveloped land generally bounded by Souza Road to the north, Route 24 to the south, Fish Road to the east, and Main Road to the west. Access to the development will be provided by a new signalized driveway off Main Road and two unsignalized driveways along Souza Road.

This report describes the proposed mixed-use development program and analyzes the project-related traffic impacts on roadways adjacent to the site and the access driveways.

Project Description

The proposed project will construct a 454,481± square foot mixed-use development known as the Tiverton Crossing that will consist of a hotel, restaurants, residential, office, and retail space. The 63.4± acres site is currently undeveloped land and generally bounded by Souza Road to the north, Route 24 and areas of open/wooded space to the south, areas of open/wooded space to the east, and residential properties and open/wooded area to the west. As shown on the site plans, access to the proposed project will be provided by a new signalized driveway off Main Road and two unsignalized driveways along Souza Road.

Study Methodology

This traffic assessment was conducted in three phases. The first phase involved an assessment of existing traffic conditions in and around the proposed mixed-use development area. This included an inventory of existing roadway geometrics and observations of traffic flow including daily and peak period traffic counts.

The second phase utilized information assembled in the first phase and established the framework for evaluating the transportation impacts of the proposed project. In this phase, future traffic demands were forecasted for the study area roadways based

on historical growth trends, other nearby proposed mixed-use development, and the proposed development of the site. The year 2018, which reflects a five (5) year horizon, was selected as the design year for analysis of this traffic impact and access study. The traffic analysis conducted in this phase identified existing and expected future roadway operations.

The third and final phase identified and analyzed potential measures to improve future traffic operations by mitigating any traffic-related impacts associated with the proposed site development.

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Existing Conditions

Existing roadway and traffic conditions in the study area were determined based on field visits and traffic counts. The existing transportation conditions in the study area, including roadway geometrics, traffic controls, and daily and peak hour traffic flows are described in the following sections.

Study Area

To effectively evaluate the transportation impacts associated with the proposed mixed-use development, it was necessary to review the existing roadway system in the vicinity of the site. The area delineated for this study includes Main Road (Route 138), Souza Road, Fish Road, and Route 24. The following critical intersections are located in the immediate vicinity of the site:

- Main Road (Route 138) at Souza Road
- Main Road (Route 138) at the Route 24 Southbound Ramps
- Main Road (Route 138) the Route 24 Northbound Ramps
- Fish Road at Souza Road
- Fish Road at the Route 24 Southbound Ramps
- Fish Road at the Route 24 Northbound Ramps

Roadway Geometry

Roadways

Main Road

Main Road is a two-lane urban minor arterial roadway that is generally oriented in a north-south direction along the project site and provides access to Route 24. North of Route 24, Main Road becomes Route 138 providing direct connection to the City of Fall River Massachusetts and Interstate 195. South of Route 24, Main Road becomes Route 77 and connects Little Compton and Route 177. Between the Route 24

northbound and southbound ramps, Main Road is a four-lane roadway. Main Road is a designated bike route.

The posted speed limit through the study area is 35 miles per hour (mph). In the vicinity of the project site, Main Road consists of two 12 to 17-foot wide travel lanes separated by a double solid yellow centerline. Sidewalk is present along both sides of Main Road in the vicinity of Route 24 and along the west side between John Street and Souza Road. Land use along the roadway consists of commercial and residential properties along with areas of open and wooded space.

Fish Road

Fish Road is a two-lane urban minor arterial roadway that is generally oriented in a north-south direction. Between the Route 24 northbound and southbound ramps, Fish Road is a four-lane roadway. The posted speed limit through the area is 35 miles per hour (mph). In the vicinity of Souza Road, Fish Road consists of one 11 to 12-foot travel lane in each direction separated by a double solid yellow center line. Sidewalk is not present along either side of Fish Road within the study area. There is a Park and Ride facility directly across from Souza Road. Land use along the roadway consists of residential and commercial properties along with areas of open and wooded space.

Souza Road

Souza Road is a two-lane roadway that is generally oriented in an east-west direction along the development site, between Main Road and Fish Road. The posted speed limit is 35 mph. Souza Road consists of one 11-foot travel lane in each direction separated by a double solid yellow center line. Sidewalk is not present along either side of Souza Road. Land use along the roadway consists of residential and commercial properties along with areas of open and wooded space (primarily on the south side of the roadway).

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Intersections

Main Road at Souza Road and Schooner Drive

Souza Road and Schooner Drive intersect Main Road (Route 138) from the east and west, respectively, to form a four-legged unsignalized intersection under STOP-sign control. The northbound and southbound approaches of Main Road consist of one general purpose lane under free movement. The Schooner Drive eastbound and Souza Road westbound approaches consist on one general purpose lane under

STOP-sign control. Sidewalk is present only along the west side of Main Road, north and south of the intersection.

Main Road at the Route 24 Southbound Ramps and the Sakonnet Bay Manor Driveway

The Route 24 southbound off-ramp and the driveway serving the Sakonnet Bay Manor assisted living facility intersect Main Road (Route 138) from the east and west, respectively, to form a four legged, unsignalized intersection. The Route 24 southbound on-ramp is offset to the south of the Sakonnet Bay Manor driveway. The Main Road northbound approach consists of two 11-footwide travel lanes, with the leftmost lane being a shared left-turn/through lane and the rightmost lane being an exclusive through lane. The Main Road southbound approach consists of a 12-foot wide shared through/right-turn lane. The Route 24 southbound off-ramp westbound approach consists of a 26-foot wide ramp that splits into a 17-foot wide left-turn lane and an 18-foot wide right-turn lane under Stop-sign control. These lanes are separated by a raised island at the intersection, with an unsignalized crosswalk present across both lanes. The Sakonnet Bay Manor assisted living facility driveway intersects Main Road from the west, opposite the Route 24 westbound off-ramp island, and consists of a 22-foot paved drive that provides two-way travel under STOP control, although a STOP-sign is not currently provided. The Route 24 southbound on-ramp departs from Main Road just south of the Sakonnet Bay Manor driveway and consists of a 26-foot wide ramp, with an unsignalized crosswalk present across both departure lanes. Sidewalk is present along both sides of Main Road, north and south of the intersection.

It should be noted that under the Route 24/Main Road Bridge Replacement and Interchange Improvements project, traffic signal conduit has been installed at the southbound off-ramp when the traffic signal was installed at the northbound off-ramp. Based on the weekday evening and Saturday midday peak hour volumes, it appears that the peak hour signal warrant is met.

Main Road at the Route 24 Northbound Ramps

The Route 24 northbound off-ramp intersects Main Road (Route 77) from the west, with the northbound on-ramp departing from Main Road to the east, forming a four-legged signalized intersection. The northbound approach of Main Road consists of a 21-foot wide travel lane that splits into an exclusive 13-foot wide right-turn lane accessing the Route 24 on-ramp and a 12-foot wide through lane. These lanes are separated by a painted gore. The southbound approach of Main Road consists of a through lane and a shared through/right-turn lane at approximately 200 feet north of the traffic signal. The southbound approach at the traffic signal consists of two through lanes. The Route 24 northbound off-ramp consists of a 26-foot wide ramp that separates into a 19-foot wide left-turn lane and a 17-foot wide right-turn lane. Left and right-turn movements are separated by a raised island at the intersection. The Route 24 northbound on-ramp departs form Main Road to the east and provides

a 26-foot wide ramp. Right-turns from the Main Road northbound approach to the on-ramp exit prior to the intersection by way of a channelized right-turn slip-ramp. Both Route 24 northbound on and off-ramps have unsignalized crosswalks. Sidewalks are provided along both sides of Main Road, north and south of the intersection.

Traffic movements at the Route 24 northbound off-ramp/Main Road intersection are controlled by a fully actuated three-phase traffic signal. Phase 1 is the Main Road northbound and southbound approaches and Phase 2 is the Route 24 northbound off-ramp approach. Phase 3 is the exclusive pedestrian phase crossing the Main Road southbound approach.

Fish Road at Souza Road

Souza Road intersects Fish Road from the west to form a three-legged, unsignalized, 'T'-type intersection under STOP-sign control. The Fish Road northbound and southbound approaches consist of an 11 to 12-foot wide general purpose lane. The directions of travel along Fish Road are separated by a solid double yellow centerline to the north and south of the intersection. The Souza Road eastbound approach consists of an 11-foot wide general purpose travel lane under STOP-sign control. The directions of travel along Souza Road are separated by a solid double yellow centerline. Sidewalks are not present along the intersecting roadways.

Fish Road at the Route 24 Southbound Ramps

The Route 24 southbound off-ramp intersects Fish Road from the east, with the southbound on-ramp departing from Fish Road to the west, forming a four-legged, unsignalized intersection under STOP and YIELD-sign control. Fish Road northbound and southbound approaches consist of two 12 to 13-foot wide travel lanes. The directions of travel along Fish Road are separated by a raised median. The Route 24 southbound off-ramp westbound approach consists of a 26-foot wide ramp that splits into a 20-foot wide left-turn lane under STOP-sign control and a 16-foot wide right-turn lane under YIELD-sign control. Left and right-turn movements from the off-ramp are separated by a raised island at the intersection. The Route 24 southbound on-ramp departs from Fish Road to the west and consists of a 26-foot wide ramp. Right turns from the Fish Road southbound approach to the on-ramp exit prior to the intersection by way of a channelized right-turn slip ramp. Sidewalks are not present along the intersecting roadways.

Fish Road at the Route 24 Northbound Ramps

The Route 24 northbound off-ramp intersects Fish Road from the west, with the northbound on-ramp departing from Fish Road to the east, forming a four-legged, unsignalized intersection under STOP-sign control. The Fish Road northbound and

southbound approaches consist of two 12 to 13-foot travel lanes. The directions of travel along Fish Road are separated by a raised median. The Route 24 northbound off-ramp eastbound approach consists of a 12-foot wide left-turn lane and a 13-foot wide right-turn lane, and vehicles approaching Fish Road under STOP-sign control. The Route 24 northbound on-ramp departs from Fish Road to the east and provides a 26-foot wide ramp. Sidewalks are not present along the intersecting roadways.

It should be notes that a temporary traffic signal has been installed at this intersection during the Sakonnet River Bridge project. The temporary traffic signal has since been removed.

Observed Traffic Volumes

To quantify existing weekday morning and evening and Saturday midday peak hour traffic volumes, manual turning movement counts (TMCs) were conducted at the study area intersections. The counts were conducted on Thursday, June 27, 2013 from 7:00 AM to 9:00 AM and from 3:30 PM to 5:30 PM and on Saturday, June 29, 2013 from 11:00 AM to 2:00 PM.

It was determined from the TMCs that traffic volumes along Main Road peak between 8:00 AM and 9:00 AM during the weekday morning peak period while Fish Road traffic volumes peak between 7:30 AM and 8:30 AM. During the weekday evening peak hour period, Main Road peaks between 3:30 PM and 4:30 PM while Fish Road peaks between 4:30 PM and 5:30 PM. The peak hour during the Saturday midday period occurs between 11:15 AM and 12:15 PM along both the Main Road and Fish Road corridors.

Seasonality

To determine the seasonal fluctuation of traffic volumes within the study area, historical traffic data were reviewed from the Rhode Island Department of Transportation (RIDOT) records. The RIDOT data indicate that traffic volumes observed during the month of June for an urban arterial are approximately 4 percent higher than the average conditions. The data also indicate that traffic volumes observed on a Thursday during the month of June for an urban arterial are approximately 10 percent higher than the average conditions. To provide a conservative analysis, the June traffic counts were not adjusted down to represent the average conditions. The resulting 2013 existing conditions traffic volume network is summarized in Figure 1 for the weekday morning and evening and Saturday midday peak hours.

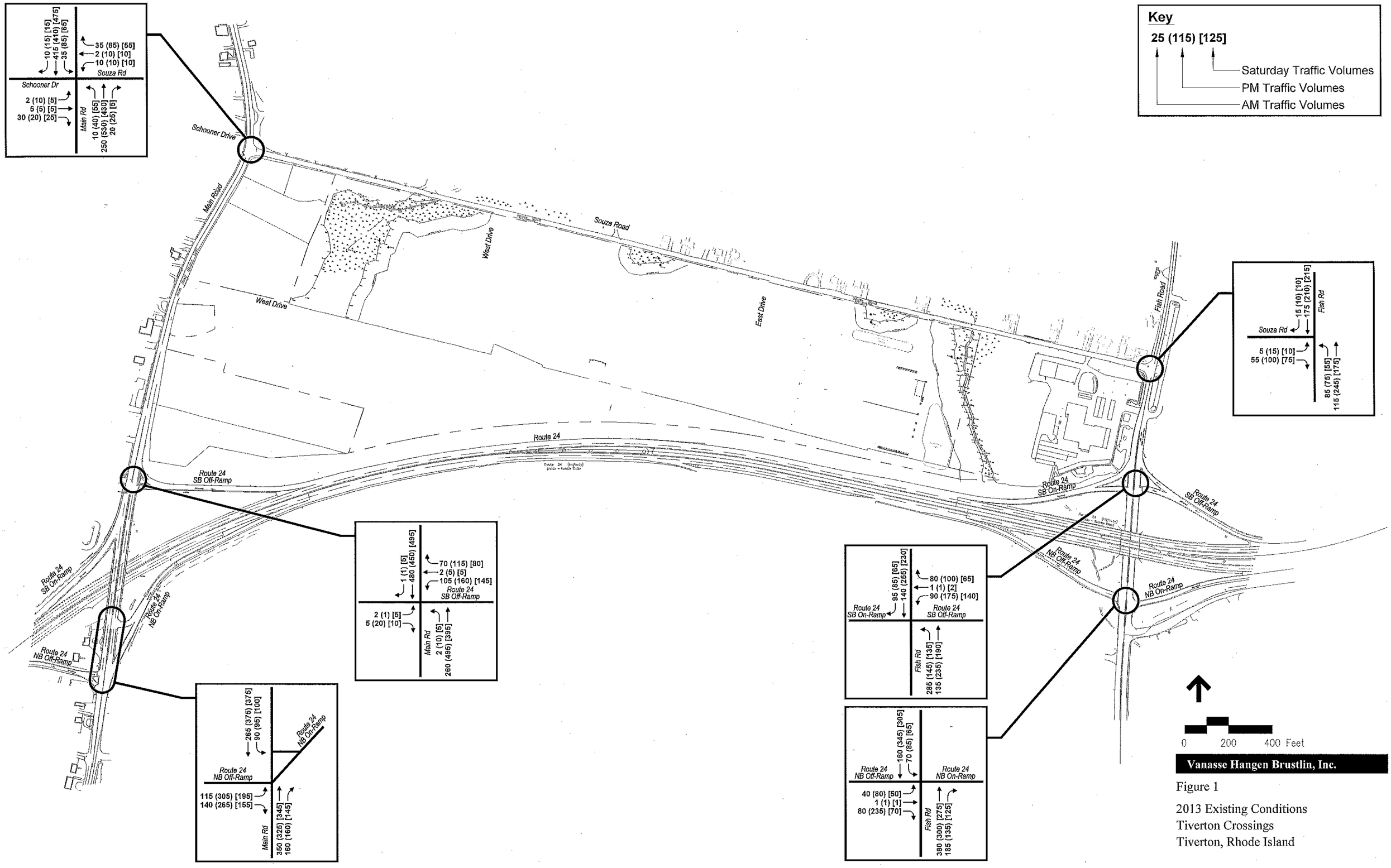

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Figure 1

2013 Existing Conditions
Tiverton Crossings
Tiverton, Rhode Island

Crash History

Traffic crash data for the most current three year period (2010 through 2012) were obtained from the RIDOT – Traffic Research Unit records for the critical intersections (as previously listed) in near proximity to the Tiverton Crossings development project. VHB has reviewed and summarized the crash data for these locations as shown in Table 1. The following is a brief summary of the crash issues occurring at each intersection reviewed.

At the unsignalized intersection of Main Road (Route 138) and Souza Road, there was an average of 2 crashes per year recorded from 2010 through 2012. Review of the crash data at this location indicate that 3 of the 5 crashes reported were "single-vehicle" type crashes involving vehicles departing the roadway.

At the unsignalized intersection of Main Road (Route 138) and the Route 24 Southbound Ramps, there was an average of 15 crashes per year recorded from 2010 through 2012. Review of the crash data at this location indicate that 38 of the 46 crashes reported were "rear end" type crashes. The majority of the rear end crashes are attributed to driver error merging onto Route 24 Southbound from the Main Road on-ramp.

At the signalized intersection of Main Road (Route 138) and the Route 24 Northbound Ramps, there was an average of 4 crashes per year recorded from 2010 through 2012. Review of the crash data at this location indicate that 5 of the 13 crashes reported were "rear end" type crashes. These crashes are mainly attributed to driver error while exiting or entering the Route 24 Northbound ramps.

At the unsignalized intersection of Fish Road and Souza Road, there was an average of 2 crashes per year recorded from 2010 through 2012. Review of the crash data at this location indicate that a majority of crashes were attributed to left turn movements leaving Souza Road and Fish Road.

At the unsignalized intersection of Fish Road and the Route 24 Southbound ramps, there was an average of 4 crashes per year recorded from 2010 through 2012. Review of the crash data at this location indicate that 6 of the 12 crashes reported were of the "angle" type crashes. This may be attributed to the lack of a traffic signal on the westbound approach of the Route 24 Southbound off-ramp, signalizing left-turn movements.

At the temporary signalized intersection of Fish Road and the Route 24 Northbound ramps, there was an average of 4 crashes per year recorded from 2010 through 2012. Review of the crash data at this location indicate that 6 of the 13 crashes reported were of the "angle" type crashes. This may be attributed to drivers' failure to comply

with the temporary traffic signal and drivers not being accustomed to having a traffic signal at this intersection.

Table 1
Intersection Crash Summary (2010-2012)

	Main Road (Route 138) at Souza Road	Main Road (Route 138) at Rt.24 SB Ramps	Main Road (Route 138) at Rt. 24 NB Ramps
Year			
2010	2	18	0
2011	3	8	5
2012	0	20	8
Total	5	46	13
Average	2	15	4
Collision Type			
Angle	1	1	2
Head-on	0	0	0
Rear-end	0	38	5
Sideswipe	1	2	0
Single-vehicle crash	3	4	5
Unknown/Other	0	1	1
Total	5	46	13
Severity			
Fatal (K)	0	0	0
Incapacitating (A)	1	1	0
Injury Evident (B)	2	3	0
Injury Possible (C)	0	10	2
Property Damage Only (PDO)	2	32	11
Unknown	0	0	0
Total	5	46	13
Time of day			
Weekday, 7:00 AM - 9:00 AM	0	8	2
Weekday, 9:00 AM – 4:00 PM	2	17	4
Weekday, 4:00 PM – 6:00 PM	0	12	0
Weekday, 6:00 PM – 7:00 AM	3	9	7
Weekend	0	0	0
Total	5	46	13
Pavement Conditions			
Dry	3	33	10
Wet	1	12	0
Snow	0	1	0
Ice/Frost	1	0	3
Other	0	0	0
Unknown	0	0	0
Total	5	46	13

Source: RIDOT. Compiled by VHB

Table 1 (Continued)
Intersection Crash Summary (2010-2012)

	Fish Road at Souza Road	Fish Road at Rt.24 SB Ramps	Fish Road at Rt. 24 NB Ramps
Year			
2010	2	1	2
2011	2	7	2
2012	1	4	9
Total	5	12	13
Average	2	4	4
Collision Type			
Angle	1	6	6
Head-on	1	0	0
Rear-end	2	2	4
Sideswipe	0	0	0
Single-vehicle crash	1	4	3
Unknown/Other	0	0	0
Total	5	12	13
Severity			
Fatal (K)	0	0	0
Incapacitating (A)	0	0	0
Injury Evident (B)	1	0	0
Injury Possible (C)	2	2	3
Property Damage Only (PDO)	2	10	10
Unknown	0	0	0
Total	5	12	13
Time of day			
Weekday, 7:00 AM - 9:00 AM	1	2	1
Weekday, 9:00 AM – 4:00 PM	1	4	8
Weekday, 4:00 PM – 6:00 PM	1	2	0
Weekday, 6:00 PM – 7:00 AM	2	4	4
Weekend	0	0	0
Total	5	12	13
Pavement Conditions			
Dry	5	9	12
Wet	0	3	1
Snow	0	0	0
Ice/Frost	0	0	0
Other	0	0	0
Unknown	0	0	0
Total	5	12	13

Source: RIDOT. Compiled by VHB

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Future Conditions

Transportation conditions in the study area can be expected to change in the future due to potential development/growth and planned transportation infrastructure improvements in the area. Traffic studies for proposed mixed-use developments typically use a five-year traffic planning horizon. To assess the magnitude of that change, traffic volumes were projected to the year 2018 to reflect growth without ("No-Build") and with ("Build") the development project and analyzed. The 2018 No-Build projected traffic volumes include growth in traffic volumes associated with generalized regional growth and the redistribution of traffic resulting from the planned transportation infrastructure improvements. The anticipated site-generated traffic volumes superimposed upon the 2018 No-Build peak hour traffic volume network reflect the 2018 Build peak hour conditions.

Background Traffic Growth

Traffic growth on area roadways is a function of the expected land development, economic activity, and changes in demographics. Several methods can be used to estimate this growth. A procedure frequently employed is to estimate an annual percentage increase and apply that increase to study area traffic volumes. An alternative procedure is to identify estimated traffic generated by planned new major developments that would be expected to impact the project study area roadways. For the purpose of this assessment, both methods were utilized. The following sections describe the procedures used to arrive at the No-Build traffic volume networks.

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Background Traffic Growth

To predict a rate at which traffic can be expected to grow during the five year forecast period (2013 - 2018), historical traffic data from the RIDOT, RI Statewide Planning Program's Technical Paper 157, and recent traffic studies conducted in the area were reviewed. Both the RIDOT and Statewide Planning data show some moderate growth of less than 1.0 percent but to be conservative and consistent with recent traffic studies in the area, a 1.5 percent per year background growth was utilized for the No-Build analysis. The 1.5 percent will account for traffic from any currently unknown minor development projects in the area.

Planned Development

Based on the discussion with the Planning Department of the Town of Tiverton and RIDOT, and reviewing recent traffic studies in the area, the following projects were identified that would have an impact on the future traffic volumes in the vicinity of the project site.

- The Village at Mount Hope Bay
- Harbor Ridge Residential Development
- Bayview Mixed-use Development
- Cattrell Farm Residential Development
- Proposed Toll Brothers Residential Development
- Tiverton Industrial Park

The above developments are expected to be substantially complete within the 2018 horizon year. The building programs and the associated site-generated trips for each development are well documented in the Traffic Impact and Access Study for the Tiverton Cross Roads project[1] prepared by Vanasse & Associates, Inc. in 2008. Under the Tiverton Industrial Park development, the reconstruction of the Route 24/Fish Road interchange and the installation of traffic signals at the intersections of Fish Road with the Route 24 ramps and at the intersection of Fish Road at Industrial Way were identified as necessary improvements to accommodate the anticipated level of development within the industrial park. As such, the improvements were included in the 2018 No-Build and Build conditions analyses.

Transportation System Improvements

Based on the discussion with the Planning Department of the Town of Tiverton and RIDOT, the proposed toll facility on the Sakonnet River Bridge would alter the travel patterns along the Main Road and Fish Road corridors. A traffic impact analysis has been prepared by Commonwealth Engineers & Consultants, Inc. (CE&C) to evaluate the traffic impacts along the possible diversionary routes as a result of installing an All Electronic Toll Collection (AETC) system on Route 24 at the Sakonnet River Bridge[2]. The shift in traffic is expected to be minimal by the year 2018 future conditions and would only have a minor effect on the traffic flow along Main Road. This projected shift in traffic is included in the 2018 No-Build and 2018 Build conditions.

As discussed earlier, the volumes threshold for the peak hour signal warrant was met during the weekday evening and Saturday midday peak hour periods under

[1] Traffic Impact and Access Study, Tiverton Cross Roads, Tiverton, Rhode Island; Vanasse & Associates, Inc., March 2008
[2] Sakonnet River Bridge Traffic Impact Analysis Volume 1, Tiverton/Portsmouth, Rhode Island; CE&C, January 2013

existing conditions at the intersection of Main Road at Route 24 Southbound Off-Ramp. It is assumed that a traffic signal will be installed at this intersection under the 2018 No-Build conditions. Traffic signal conduits have been installed at the Route 24 southbound off-ramp when the traffic signal was installed at the northbound off-ramp under the Route 24/Main Road Bridge Replacement and Interchange Improvements project.

2018 No-Build Traffic Volumes

The 2018 No-Build peak hour traffic volumes were determined by applying the 1.5% annual growth rate to the 2013 Existing peak hour traffic volumes, adding the site generated trips by other planned developments, and including the shift in traffic resulting from the Sakonnet River Bridge toll study. The 2018 No-Build weekday morning and evening and Saturday midday peak hour traffic volumes are shown in Figure 2.

Site-Generated Traffic Volumes

Design year 2018 Build traffic volumes were determined by estimating site-generated trips for the proposed development project and distributing these trips over the study area roadways. These site-generated trips were added to the 2018 No-Build traffic volumes to develop the Build weekday morning and evening peak hour traffic volumes. The following sections describe the procedures used to arrive at the Build traffic volume networks.

Trip Generation

To estimate traffic impacts of the proposed development it is necessary to determine the traffic volumes expected to be generated by the proposed mixed-use development. The following text discusses the procedures used to determine the expected trip generation of the proposed mixed-use development.

Proposed Mixed-Use Trip Generation

For the purpose of this assessment, traffic projections for the proposed mixed-use development were derived from trip generation rates published by the Institute of Transportation Engineers (ITE) Trip Generation[3]. After reviewing the trip generation characteristics, VHB used "Shopping Center" (Land Use Code [LUC] 820) for the 366,700± square feet of proposed retail; "General Office Building" (LUC 710) for the

[3] Trip Generation, 9th Edition; Institute of Transportation Engineers (ITE); Washington, D.C.; 2012.

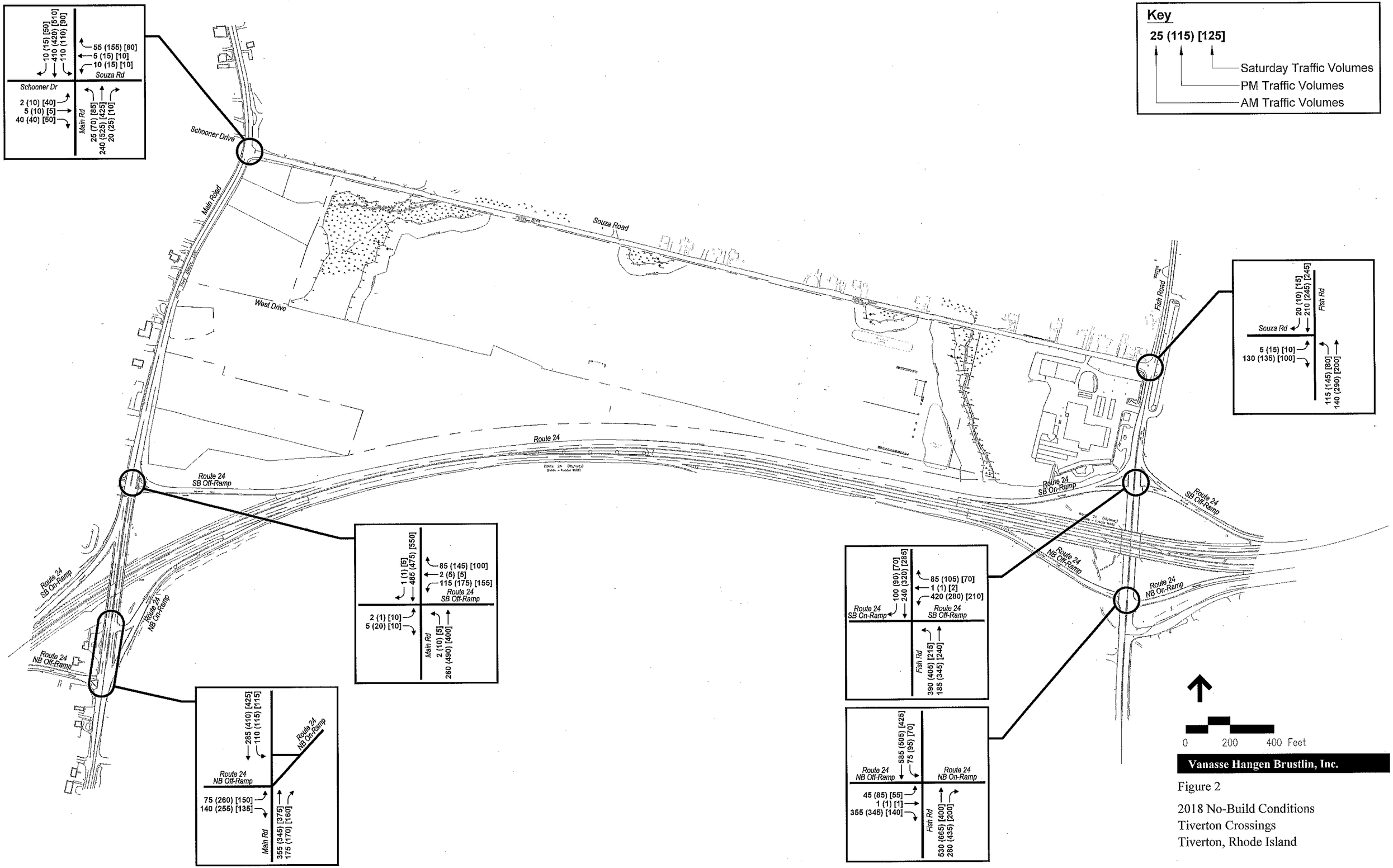

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Figure 2

2018 No-Build Conditions
Tiverton Crossings
Tiverton, Rhode Island

86,000± square feet of proposed office space; "Condo/Townhouse" (LUC 230) for the 150 units of proposed residential space; "Hotel" for the 100 rooms of proposed hotel accommodations, and "Quality Restaurant" (LUC 931) for the 22,000± square feet to determine the traffic characteristics of the projected project.

Table 2 summarizes the site-generated trips for each of the uses assumed above. The trip generation worksheets are included in the Appendix.

Pass-By/Diverted/Internal Captured Trips

Not all of the traffic generated by the site will be new traffic on study area roadways. A portion of the vehicle-trips generated by the proposed site will be drawn from the existing traffic streams passing the site in the form of pass-by traffic or from roadways in the vicinity of the site in the form of diverted-link traffic. The primary destination of pass-by traffic is elsewhere and the primary trip will be resumed following a stop at the proposed site. In addition to pass-by trips, a significant number of trips to retail facilities are diverted trips. For this development diverted trips will be trips diverted from other retail facilities into the proposed site. Customers will not have to travel past the site to travel to and from other retail facilities.

Based on ITE data, pass-by trip/diverted trip rates of as high as 94 percent with an average rate of 61 percent are typical for shopping centers. In order to remain conservative and to provide greater flexibility for the development when analyzing the impacts the proposed site will have on traffic, it was assumed all of the site-generated trips for the retail uses would be all new trips to the study area (no pass-by/diverted trips).

In addition to the pass-by/diverted trips, a portion of the trips generated by the proposed mixed-use development will be drawn internally "captured" on the site. Again to remain conservative, it is assumes that there will be no captured trip.

As shown in Table 2, the proposed mixed-use development is projected to result in approximately 645 new weekday morning peak hour trips (410 entering and 235 exiting). During the weekday evening peak hour, the proposed development is projected to result in approximately 1,915 new trips (910 entering and 1,005 exiting). And during the Saturday peak hour, the proposed development is projected to result in approximately 2,470 new trips (1,305 entering and 1,165 exiting).

Table 2
Proposed Mixed-Use Trip Generation Summary

Time Period/ Movement	Retail[1]	Office[2]	Condo[3]	Hotel[4]	Restaurant[5]	Total Gross Trips
Weekday Daily[6]						
Enter	7,900	585	460	260	990	10,195
Exit	7,900	585	460	260	990	10,195
Total	15,800	1,170	920	520	1,980	20,390
Morning Peak[7]						
Enter	215	150	10	25	10	410
Exit	130	20	60	15	10	235
Total	345	170	70	40	20	645
Evening Peak[7]						
Enter	685	30	55	30	110	910
Exit	745	145	30	30	55	1005
Total	1,430	175	85	60	165	1,915
Weekday Daily[6]						
Enter	10,475	105	485	335	1040	12,440
Exit	10,475	105	485	335	1040	12,440
Total	20,950	210	970	670	2,080	24,880
Saturday Peak[7]						
Enter	1,060	20	45	40	140	1,305
Exit	975	15	40	35	100	1,165
Total	2,035	35	85	75	240	2,470

Source: Trip Generation, 9th Edition; Institute of Transportation Engineers (ITE); Washington, D.C. (2012)

1. Based on ITE Land Use Code 820 (Shopping Center) for 366,700 sf proposed retail development
2. Based on ITE LUC 710 (General Office Building) for 86,000 sf proposed office space
3. Based on ITE LUC 230 (Condo) for150 units proposed residential space
4. Based on ITE LUC 310 (Hotel) for 100 rooms
5. Based on ITE LUC 931 (Quality Restaurant) for 22,000 sf proposed floor area
6. Traffic volumes expressed in trips per day
7. Traffic volumes expressed in trips per hour

Trip Distribution and Assignment

Having estimated project generated vehicle trips, the next step in the study is to determine the trip distribution of project traffic and assign these trips to the roadway network. The directional distribution of site traffic approaching and departing the development is a function of several variables. These include the population densities, shopping opportunities, competing uses, existing and proposed travel patterns, and the efficiency of the roadways leading to the site.

The trip distribution for this project was based on a combination of existing travel patterns and the trip distribution developed for recent traffic studies in the area. The projected new trips associated with the proposed mixed-use development were distributed on the study area roadways based on the following assumptions:

- 10% from the north on Main Road (Route 138)
- 5% from the east on Route 24 Southbound
- 25% from the west on Route 24 Northbound
- 5% from the south on Main Road (Route 77)
- 5% from the north on Fish Road Southbound
- 40% from the east on Route 24 Southbound
- 10% from the south on Fish Road Northbound

2018 Build Traffic Volumes

These site-generated trips described above were added to the 2018 No-Build traffic volumes to develop the Build weekday morning and evening and Saturday midday peak hour traffic volumes. The resulting 2018 Build weekday morning and evening and Saturday midday peak hour traffic volumes are shown in Figure 3.

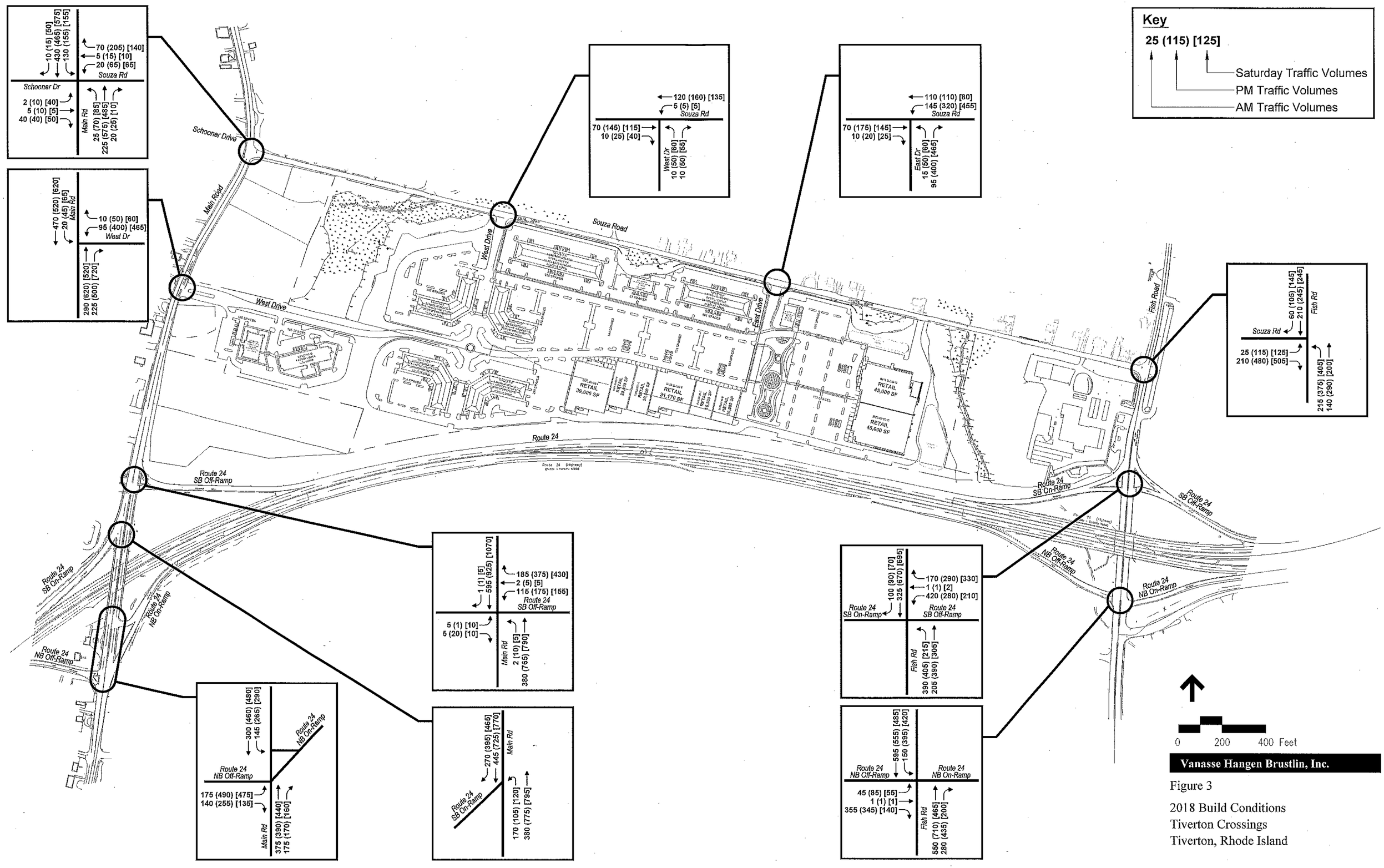

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Figure 3

2018 Build Conditions
Tiverton Crossings
Tiverton, Rhode Island

4

Traffic Operations

Measuring existing traffic volumes and projecting future traffic volumes quantifies traffic flow within the study area. To assess quality of flow, roadway capacity analyses were conducted with respect to Existing and projected No-Build and Build conditions. Capacity analyses provide an indication of how well the roadway facilities serve the traffic demands placed upon them. Roadway operating conditions are classified by calculated levels of service as described in the following sections.

Mitigation measures (as shown in Figure 4 following page 25) to accommodate existing, No-Build and Build traffic conditions are also proposed and analyzed below.

Level of Service Criteria

Level of Service (LOS) is the term used to describe the different operating conditions that occur on a given roadway segment or intersection under various traffic volume loads. It is a qualitative measure of the effect of a number of factors including roadway geometrics, travel delay, and freedom to maneuver. Level of service designations range from A to F, with LOS A representing the best operating conditions and LOS F representing the worst operating conditions.

The level of service designation is reported differently for signalized and unsignalized intersections. For signalized intersections, the analysis considers the operation of all traffic entering the intersection, and the LOS designation is for overall conditions at the intersection. For unsignalized intersections, the analysis assumes that traffic on the mainline is not affected by traffic on the side streets. The LOS is only determined for left turns from the main street and all movements from the minor street. The overall LOS designation is for the most critical movement, which is most often the left turn out of the side street.

Unsignalized Intersections Capacity Analysis

Unsignalized capacity analyses were conducted for the unsignalized intersections of Main Road at Souza Road/Schooner Drive, Main Road at the Route 24 Southbound ramps, Fish Road at Souza Road, Fish Road at the Route 24 Southbound ramps, and

Fish Road at the Route 24 Northbound ramps. This section includes a discussion of the operations at the unsignalized intersections under 2013 Existing, 2018 No-Build, and 2018 Build conditions. For this study, the capacity analyses were completed using Synchro 7 software, with output based on the *2000 Highway Capacity Manual* (HCM)[4]. Table 3 summarizes the unsignalized intersection capacity analyses. The HCM output is included in Appendix D.

Table 3
Unsignalized Intersection Capacity Analysis Summary

Intersection Peak Hour	2013 Existing				2018 No-Build				2018 Build			
	Critical Movement[1]	Demand[2]	Delay[3]	LOS[4]	Critical Movement	Demand	Delay	LOS	Critical Movement	Demand	Delay	LOS
Main Road at Route 24 SB Off-Ramp												
Weekday Morning:	WB LT	105	27.7	D								
Weekday Evening:	WB LT	165	>100	F		Signalized				Signalized		
Saturday Midday:	WB LT	150	60.5	F								
Main Road at Souza Rd/Schooner Dr												
Weekday Morning:	WB LTR	47	14.2	B	WB LTR	70	16.5	C	WB LT	105	19.2	C
Weekday Evening:	EB LTR	35	42.8	E	EB LTR	60	97.1	F	EB LTR	60	>100	F
Saturday Midday:	EB LTR	35	20.8	C	EB LTR	95	>100	F	EB LTR	95	>100	F
Fish Road at Souza Road												
Weekday Morning:	EB LR	60	10.4	B	EB LR	135	11.9	B	EB L	25	25.7	D
Weekday Evening:	EB LR	190	12.5	B	EB LR	150	15.4	C	EB L	115	>100	F
Saturday Midday:	EB LR	85	10.6	B	EB LR	110	11.3	B	EB L	125	>100	F
Fish Road at Route 24 SB Off-Ramp												
Weekday Morning:	WB LT	90	27.9	D								
Weekday Evening:	WB LT	175	38.3	E		Signalized				Signalized		
Saturday Midday:	WB LT	140	24.0	C								
Fish Road at Route 24 NB Off-Ramp												
Weekday Morning:	EB LT	40	15.4	C								
Weekday Evening:	EB LT	80	25.1	D		Signalized				Signalized		
Saturday Midday:	EB LT	50	17.4	C								
Souza Road at West Driveway												
Weekday Morning:									NB LR	20	9.3	A
Weekday Evening:		Does Not Exist				Does Not Exist			NB LR	100	10.7	B
Saturday Midday:									NB LR	115	10.6	B
Souza Road at East Driveway												
Weekday Morning:									NB LR	20	9.3	A
Weekday Morning:		Does Not Exist				Does Not Exist			NB LR	100	10.7	B
Saturday Midday									NB LR	115	10.6	B

1 L= Left-turn movement, T= Through movement, R= Right-turn movement
2 Demand = Demand of critical movement, expressed in vehicles per hour
3 Delay = Vehicle delay expressed in seconds per vehicle (See note below)
4 LOS = Level of service

[4] Highway Capacity Manual, HCM 2000, Transportation Research Board, National Research Council, Washington, D.C., 2000

It should be noted that the typical analytical methodologies for unsignalized intersections use conservative parameters such as high critical gaps. Actual field observations indicate that drivers on minor streets and driveways generally accept smaller gaps in traffic than the default values and therefore experience less delay than reported by the analysis software. The net effect of these analysis procedures is the over-estimation of calculated delays. Cautious judgment should be exercised when interpreting unsignalized capacity analysis results.

Main Road at Route 24 Southbound Off-Ramp

As shown in Table 3, the Route 24 southbound off-ramp westbound left-turn/through movements operate at LOS D during the weekday morning peak hour and at LOS F during both the weekday evening and Saturday midday peak hour periods. As discussed earlier, the volume threshold for the peak hour signal warrant were met during the weekday evening and Saturday midday peak hour periods under existing conditions. Traffic signal conduits have been installed at the Route 24 southbound off-ramp when the traffic signal was installed at the Route 24 northbound off-ramp under the Route 24/Main Road Bridge Replacement and Interchange Improvements project. Therefore, it is assumed that a traffic signal will be installed at this intersection under the 2018 No-Build conditions.

Main Road at Souza Road/Schooner Drive

Souza Road westbound left-turn/through/right-turn movements are the critical movements during the weekday morning peak hour and operate at LOS B. During the weekday evening and Saturday midday peak hour periods, the Schooner Drive eastbound left-turn/through/right-turn movements are the critical movements and operating at LOS E and LOS C, respectively.

With the expected traffic volumes generated by the background growth and other developments under the 2018 No-Build conditions, the Souza Road westbound left-turn/through/right-turn movements are projected to operate at LOS C during the weekday morning peak hour. The Schooner Drive eastbound left-turn/through/right-turn movements are projected to operate at LOS F under both the weekday evening and Saturday midday peak hour periods.

With the proposed site generated trips under the 2018 Build conditions, the Souza Road westbound left-turn/through/right-turn movements will continue to operate at LOS C during the weekday morning peak hour. The Schooner Drive eastbound left-turn/through/right-turn movements are projected to operate at LOS F under both the weekday evening and Saturday midday peak hour periods. It is important to note that most of the proposed site generated trips will be right-turns from Souza

Road onto Main Road. Adding a right-turn lane on the Souza Road westbound approach and a left-turn lane on the Main Road southbound approach will help minimize the impacts of the site generated traffic; however, the 2013 Existing and 2018 No-Build left-turns from both Souza Road and Schooner Drive will continue to operate poorly. Although the volume threshold for the peak hour signal warrant is not met based on projected 2013 Build traffic volumes, the intersection should be monitor to see if a traffic signal is warranted when the project is constructed.

■

Fish Road at Souza Road

The Souza Road eastbound left-turn/right-turn movements currently operate at LOS B during all three peak hour periods due to relatively low traffic volumes on Fish Road. Under the 2018 No-Build conditions, both the weekday morning and Saturday midday peak hours are projected to continue to operate at LOS B while the weekday evening peak hour are projected to operate at LOS C. With the proposed site generated trips under the 2018 Build conditions, the weekday morning peak hour is projected to operate at LOS D while the weekday evening and Saturday midday peak hour periods are projected to operate at LOS F.

Similar to the Main Road/Souza Road intersection, most of the proposed site generated trips will be right-turns from Souza Road onto Fish Road. Adding a right-turn lane on the Souza Road eastbound approach and a left-turn lane on the Fish Road southbound approach will help minimize the impacts of the site generated traffic; however, the 2013 Existing and 2018 No-Build left-turns from Souza Road onto Fish Road will continue to operate poorly. Although the volumes threshold for the peak hour signal warrant is not met based on projected 2018 Build traffic volumes, the intersection should be monitor to see if a traffic signal is warranted when the project is constructed.

■

Fish Road at Route 24 Southbound Off-Ramp

The Route 24 southbound off-ramp westbound left-turn/through movements currently operate at LOS D, LOS E, and LOS C during the weekday morning, weekday evening, and Saturday midday peak hour periods, respectively. As discussed earlier, the installation of traffic signals at the intersections of Fish Road at the Route 24 ramps and at the intersection of Fish Road at Industrial Way were identified as necessary improvements to accommodate the anticipated level of development within the industrial park; therefore, it is assumed that the traffic signal will be install under the 2018 No-Build and Build conditions analyses.

Fish Road at Route 24 Northbound Off-Ramp

The Route 24 northbound off-ramp westbound left-turn/through movements currently operate at LOS C during both the weekday morning and Saturday midday peak hour periods while the weekday evening operate at LOS D. As discussed earlier, the installation of traffic signals at the intersections of Fish Road with the Route 24 ramps and at the intersection of Fish Road at Industrial Way were identified as necessary improvements to accommodate the anticipated level of development within the industrial park; therefore, it is assumed that the traffic signal will be install under the 2018 No-Build and Build conditions analyses.

Souza Road at Site Driveways

These driveways do not exist under Existing and 2018 No-Build conditions. Both the East and West Driveways are expected to operate at LOS B or better under 2018 Build conditions.

Signalized Intersections Capacity Analysis

Capacity analyses were conducted for the existing signalized intersections on Main Road at the Route 24 Northbound off-ramp and the future signalized intersections in the study area. For this study, the capacity analyses were completed using Synchro 7 software, with output based on the *2000 Highway Capacity Manual* (HCM)[5].A summary of the signalized capacity analyses is presented in Table 4 and 5.

[5] Highway Capacity Manual, HCM 2000, Transportation Research Board, National Research Council, Washington, D.C., 2000

Table 4
Signalized Intersection Capacity Analysis Summary

Intersection	2013 Existing			2018 No-Build			2018 Build		
Peak Hour	V/C[1]	Delay[2]	LOS[3]	V/C	Delay	LOS	V/C	Delay	LOS
Main Road at Route 24 NB Off-Ramp									
Weekday Morning:	0.41	7.1	A	0.38	6.7	A	0.47	7.6	A
Weekday Evening:	0.50	9.3	A	0.49	8.7	A	0.66	12.9	B
Saturday Midday:	0.46	8.0	A	0.45	7.5	A	0.70	14.1	B
Main Road at Route 24 SB Off-Ramp									
Weekday Morning:				0.55	7.3	A	0.62	9.1	A
Weekday Evening:		Unsignalized		0.60	9.5	A	0.89	20.9	C
Saturday Midday:				0.59	9.0	A	0.93	26.7	C
Fish Road at Route 24 NB Off-Ramp									
Weekday Morning:				0.53	14.4	B	0.62	15.1	B
Weekday Evening:		Unsignalized		0.53	12.0	B	0.84	25.5	C
Saturday Midday:				0.26	7.5	A	0.58	8.6	A
Fish Road at Route 24 SB Off-Ramp									
Weekday Morning:				0.87	22.4	C	0.81	27.0	C
Weekday Evening:		Unsignalized		0.85	17.2	B	0.87	26.9	C
Saturday Midday:				0.43	11.8	B	0.58	17.4	B
Main Road at West Site Driveway									
Weekday Morning:							0.32	4.6	A
Weekday Evening:		Does Not Exist			Does Not Exist		0.76	13.0	B
Saturday Midday:							0.81	14.9	B

1 Volume to capacity ratio
2 Vehicle delay expressed in seconds per vehicle
3 Level of Service

Table 5
Signalized Intersection Capacity Analysis Summary – with Mitigation

Intersection	2018 Build with Mitigations		
Peak Hour	V/C	Delay	LOS
Main Road at Route 24 Southbound Off-Ramp			
Weekday Morning:	0.43	7.4	A
Weekday Evening:	0.67	12.6	B
Saturday Midday:	0.71	13.9	B
Main Road at Souza Rd/Schooner Dr			
Weekday Morning:	0.40	4.9	A
Weekday Evening:	0.65	9.3	A
Saturday Midday:	0.58	7.4	A
Fish Road at Souza Road			
Weekday Morning:	0.32	10.5	B
Weekday Evening:	0.73	17.2	B
Saturday Midday:	0.57	13.1	B

1 Volume to capacity ratio
2 Vehicle delay expressed in seconds per vehicle
3 Level of Service

Main Road at Route 24 Northbound Off-Ramp

The analysis indicates that under the 2013 existing conditions, the Main Road/Route 24 northbound off-ramp traffic signal operates at LOS A during all three peak hour periods. The intersection will continue to operating at LOS A under 2018 No-Build conditions.

Under the 2018 Build conditions, the intersection will continue to operate at LOS A during the weekday morning peak hour while the weekday evening and Saturday peak hours are projected to operate at LOS B. Although traffic volumes at the intersection are projected to increase, all approaches are projected to operate at LOS B or better with minimal delays and queues.

Main Road at Route 24 Southbound Off-Ramp

The Route 24 southbound off-ramp and Sakonnet Bay Manor approaches currently operate under STOP control. As discussed earlier, the volume threshold for the peak hour signal warrant are met during the weekday evening and Saturday midday peak hour periods under existing conditions. It is assumed that a traffic signal will be installed at this intersection under the 2018 No-Build conditions.

With the installation of a traffic signal under the 2018 No-Build conditions, the intersection is projected to operate at LOS A during all three peak hour periods.

Under the 2018 Build conditions, the intersection will continue to operate at LOS A during the weekday morning peak hour while the weekday evening and Saturday peak hours are projected to operate at LOS C. Both the Main Road southbound approach and the Route 24 southbound off-ramp westbound approach is projected to operate with long delays and queues particularly during the weekday evening and Saturday midday peak hour periods.

To minimize the delays and queues, it is recommended that the Main Road southbound approach be widen to accommodate two through lanes. With the proposed improvements, the intersection is projected to operate at LOS A during the weekday morning peak hour and at LOS B during both the weekday evening and Saturday midday peak hour periods, as shown in Table 5.

Fish Road at Route 24 Northbound Off-Ramp

With the installation of a traffic signal at the Route 24 southbound off-ramp under the 2018 No-Build conditions, the intersection is projected to operate at LOS B during

both the weekday morning and evening peak hour periods while the Saturday midday peak hour is projected to operate at LOS A.

Under the 2018 Build conditions, the intersection is projected to operate at LOS B, LOS C, and LOS A during the weekday morning, evening, and Saturday midday peak hour periods, respectively.

■

Fish Road at Route 24 Southbound Off-Ramp

The Route 24 northbound off-ramp, the signal is projected to operate at LOS C during the weekday morning peak hour and at LOS B during both the weekday evening and Saturday midday peak hour periods under the 2018 No-Build conditions.

Under the 2018 Build conditions, the intersection is projected to operate at LOS C during both the weekday morning and evening peak hour while the Saturday midday peak hour is projected to operate at LOS B.

■

Main Road at West Site Driveway

With the construction of proposed mixed-use development, the traffic signal at the proposed site driveway is projected to operate at LOS A during the weekday morning peak hour and at LOS B during both the weekday evening and Saturday midday peak hour periods.

■

Main Road at Souza Road/Schooner Drive

As discussed earlier, the intersection needs to be monitored to determine if installation of a traffic signal is warranted when the proposed mixed-use development has been fully constructed. With the installation of a traffic signal, the intersection is expected to operate at LOS A during all three peak hour periods, as shown in Table 5.

■

Fish Road at Souza Road

Similar to the Main Road/Souza Road/Schooner Drive intersection, this intersection needs to be monitored to determine if installation of a traffic signal is warranted when the proposed mixed-use development has been fully constructed. With the installation of a traffic signal, the intersection is expected to operate at LOS B during all three peak hour periods, as shown in Table 5.

5

Conclusions

Access to and from the proposed development will be provided via one signalized full access site driveway on Main Road and a two unsignalized driveways driveway on Souza Road.

As discussed in this report, the proposed development will result in an increase in traffic volumes along study area roadways. There are also projected increases in traffic along study area roadways due to annual background growth and various proposed developments in the area. Some of the study area intersections require mitigation to accommodate existing traffic volumes. Other intersections will require mitigation based on projected 2018 No-Build conditions. The proposed development will require additional mitigation to accommodate projected site generated traffic volumes. The proposed mitigation is shown in Figure 4. The following is a summary of the recommended mitigation to accommodate existing, No-Build and Build traffic conditions:

The following improvements are recommended based on 2018 No-Build traffic conditions:

- Main Road at Route 24 Southbound Off-Ramp
  - Install a new traffic signal
- Fish Road at Route 24 Southbound Off-Ramp
  - Install a new traffic signal
- Fish Road at Route 24 Northbound Off-Ramp
  - Install a new traffic signal

The following improvements are recommended based on 2018 Build traffic conditions:

- Main Road at Route 24 Southbound Off-Ramp
  - Widen the Main Road Southbound approach to provide two-through lanes
- Main Road at West Site Drive
  - Install a new traffic signal
  - Widen the northbound approach to provide a free right-turn lane
  - Widen the southbound approach to provide a 100 foot left-turn lane

- Main Road at Souza Road
  - Widen the southbound approach to provide a 100 foot left-turn lane

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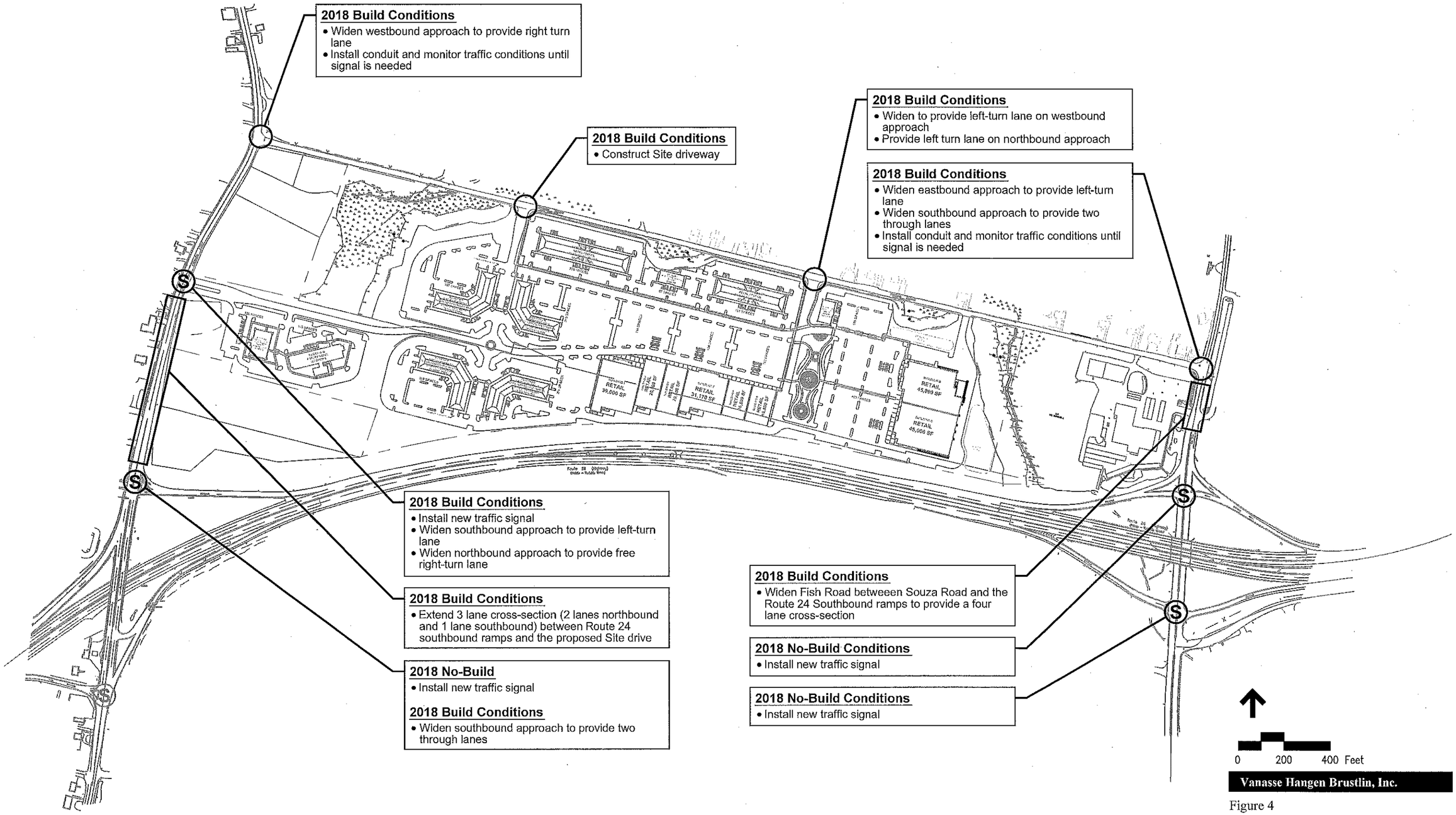

Figure 4

Proposed Mitigation
Tiverton Crossings
Tiverton, Rhode Island

- Widen the westbound approach to provide a 100 foot right-turn lane
- Install conduit and monitor traffic conditions until signal is needed

➤ Main Road between Souza Road and the Route 24 Southbound Ramps
- Widen roadway to provide 3 lanes (2 northbound and 1 southbound)

➤ Souza Road at East Driveway
- Widen the westbound approach to provide a 100 foot left-turn lane
- Widen the northbound approach to provide a 100 foot left-turn lane

➤ Fish Road at Souza Road
- Widen the eastbound approach to provide a 100 foot left-turn lane
- Widen the southbound approach to provide two through lanes (100 feet long)
- Install conduit and monitor traffic conditions until signal is needed

➤ Fish Road between Souza Road and the Route 24 Southbound Ramps
- Widen roadway to provide a four lane cross-section

With the implementation of the improvements listed above the proposed access driveways and study area intersections are projected to operate efficiently with minimal delays.